

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DANILO PAU,
ROBERTO SANNINO,
ANDREA CAPASSO,
and PASQUALINA FRAGNETO

Appeal No. 2004-1670
Application 09/390,554¹

ON BRIEF

Before KRASS, JERRY SMITH, and BARRETT, Administrative Patent Judges.

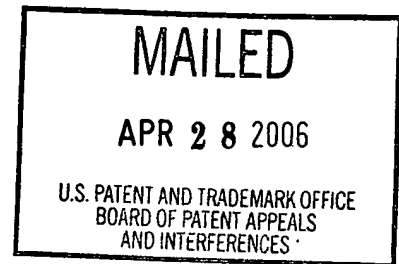
BARRETT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134(a) from the final rejection of claims 5-14.

We reverse.

¹ Application for patent filed September 3, 1999, entitled "Method and Scalable Architecture for Parallel Calculation of the DCT of Blocks of Pixels of Different Sizes and Compression Through Fractal Coding," which claims the foreign filing priority benefit under 35 U.S.C. § 119 of European Patent Office (EPO) Application 98830522.3, filed September 7, 1998.



BACKGROUND

The invention relates to a method and apparatus for calculating the discrete cosine transform (DCT) on a plurality of blocks of pixels, in parallel, and which provides for the scalability of the size of the blocks of pixels.

Claim 5 is reproduced below.

5. A method of calculating the discrete cosine transform (DCT) of blocks of pixels of an image, comprising the steps of:

defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i * N/2^i$, where i is an integer;

defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels; and

calculating, in parallel, the DCT of 2^i range blocks of a domain block of $N*N$ pixels of the image.

THE REFERENCES

The examiner relies on the following references:

Ericsson et al. (Ericsson) 5,689,592 November 18, 1997

Yao Zhao and Baozong Yuan, A hybrid image compression scheme combining block-based fractal coding and DCT, Signal Processing: Image Communication, 8 March 1996, No. 2, 73-78.

THE REJECTION

Claims 5-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhao and Ericsson.²

² The statement of the rejection in the final rejection and the examiner's answer only refers to claims "5-12."

We refer to the final rejection (Paper No. 14) (pages referred to as "FR__") and the examiner's answer (Paper No. 19) (pages referred to as "EA__") for a statement of the examiner's rejection, and to the brief (Paper No. 18) (pages referred to as "Br__") and reply brief (Paper No. 20) (pages referred to as "RBr__") for a statement of appellants' arguments thereagainst.

OPINION

The rejection and arguments

The examiner finds that Zhao teaches subdividing blocks into range and domain blocks at page 74, column 2, and shifting the domain blocks vertically and horizontally as claimed, but does not teach calculation in parallel (FR3). The examiner finds that Ericsson teaches processing images in parallel and concludes that it would have been obvious to implement Zhao using parallel processing in order to reduce processing times (FR3).

Appellants acknowledge that both Zhao and the present invention are directed to image compression based on fractal coding and DCTs, including partitioning the image into blocks, and, thus, there is some commonality between the descriptions (Br5). However, it is argued, the present invention is described and shown with reference to 23 additional drawings, which are not shown in Zhao (Br5). It is argued that there is no disclosure or teaching in Zhao of (1) any scalable DCT processing feature, or (2) parallel calculation of the DCT of such scalable range blocks

(Br6). It is argued that Ericsson recognizes the possibility of speeding up processing of images by performing certain processing algorithms in parallel, but does not suggest the method and architecture for parallel calculation of the DCT of scalable blocks of pixels of different size and compression characteristics as in the present invention (Br6). Appellants argue that there is no teaching or suggestion in the combination of references to provide scalability of the size of a plurality of blocks in pixels in the calculation of the DCT (Br6).

The examiner states (EA4):

While Zhao is not explicit about his scalability he does make reference to the fact that image quality is inversely related to the size of the macro block being encoded. See Zhao first page second paragraph. Therefore, one of ordinary skill in the art can infer scalability. The scalability would then require a mathematical formula to determine the size of the range blocks as a function of the domain blocks.

The examiner provides a complicated explanation of why the relationship of the size of the range block to the domain block during scaling would be apparent and concludes (EA5):

Therefore at the time the invention was made, it would have been obvious to one of ordinary skill in the art, to use Zhaos paper glean from it that a DCT transform can be done on different size blocks i.e. the smaller the block the higher the image quality, and simply make the transformation scalable by writing a formula.

Appellants reply that Zhao imposes a pre-definition of the dimensions of the blocks of pixels and notes that the formulas for a 2x2 DCT are different from a 4x4 DCT (RBr1-2). It is

argued that the examiner's assertion that "scalability" can be inferred is interpreted to mean that it is inherent, which finding is not necessarily true and is without basis in fact and/or technical reasoning (RBr2). It is argued that appellants are not simply writing a formula (RBr3).

The examiner finds that column 8, lines 30-38, of Ericsson clearly show that Ericsson can be used for parallel DCT processing and, therefore, it would have been obvious to combine Zhao with Ericsson's parallel processing (EA5-6).

Appellants reply that Ericsson does not suggest the method and architecture for parallel calculation of the DCT of scalable blocks of pixels of different size and compression characteristics as in the present invention (RBr3).

Analysis

Zhao discloses a hybrid fractal/DCT coding scheme. Zhao states (p. 74): "The original image is first partitioned into two types of blocks whose sizes are 8 x 8 and 16 x 16. The smaller are called range blocks which are nonoverlapping and the larger are called domain blocks which may overlap." Zhao does not expressly disclose that (1) the range blocks are "scalable," or (2) "calculating, in parallel, the DCT of 2^i range blocks of a domain block of $N \times N$ pixels of the image." Zhao discloses that the range blocks are classified into two types according to their complexity represented by a sum of values of three AC

coefficients (p. 74). A fractal transform in the DCT domain is applied to range blocks whose complexity classification exceeds a pre-defined threshold T, and only a DC coefficient of the range block is stored for range blocks with a complexity lower than the threshold T (p. 75). There does not seem to be any dispute that the hybrid/DCT coding scheme in Zhao is the same as that claimed, for example, in independent claim 8: only the limitations of claim 5, which appear in all independent claims, are at issue.

Zhao discusses in the introduction that automatic fractal image compression can provide high compression, but reconstructed images are of medium quality and "[i]n order to improve the decoded image quality, the size of divided blocks has to be decreased which results in smaller compression ratio" (p. 73). The examiner relies upon this statement not as a teaching that scalability is inherent, but as a suggestion that the size of the range blocks can be selected based on image quality and, hence, the block size is "scalable." The statement in Zhao relates to image quality using fractal image compression, and states that better image quality is obtained by decreasing the size of the blocks, which teaches that the block size is selectable. One of ordinary skill in the image encoding art knew that the image quality is related to the subimage size. See, e.g., Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing (Addison-Wesley Publ. Co. 1992), pages 374-389 (copy attached). We find

that Zhao suggests that the size of the blocks can be selected based on image quality, which reasonably suggests to one skilled in the art that the block size is scalable (i.e., able to expand or contract the size of the blocks by selection). The method claims do not recite how the scalability is accomplished and this could be done by using separate equations, or separate apparatuses, for predetermined 2x2, 4x4, and 8x8 size blocks.

Ericsson discloses a method of processing a digital signal wherein multiple signal values are simultaneously operated upon in a single register (abstract). For example, operations may be performed simultaneously (i.e., in parallel) on corresponding pixel 109 in one block and pixel 110 in an adjacent block (Fig. 1a; col. 6, lines 25-63). The operation may be a DCT (col. 8, lines 30-38). However, Ericsson only discloses performing operations in parallel on two corresponding pixels in adjacent blocks by placing each pixel in half of the register, i.e., on one pixel at a time for each block. Ericsson does not teach or suggest calculating the DCT (or other operation) on a block of pixels in parallel, and, in particular, does not teach or suggest the claim limitation of "calculating, in parallel, the DCT of 2^i range blocks of a domain block of $N*N$ pixels of the image," e.g., calculating in parallel the DCT of four ($2^{i=2}$) range blocks for a domain block of 16x16 pixels. Thus, we conclude that the combination of Zhao and Ericsson does not teach all of

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ALLEN, DYER, DOPPELT, MILBRATH & GILCHRIST P.A.
1401 CITRUS CENTER 255 SOUTH ORANGE AVENUE
P.O. BOX 3791
ORLANDO, FL 32802-3791